30. A concentration detection system comprising:

a flexural plate wave device;

an oscillator for driving the flexural plate wave device at a reference resonant frequency;

a solution deposition device for delivering a known quantity of a solution containing particles to the flexural plate wave device;

a transducer for detecting the change in frequency of the flexural plate wave device due to the particles after the solution evaporates; and

a processor configured to automatically determine the mass of the particles based on the change in frequency, and to calculate the concentration of the particles in the solution based on the mass of the particles and the quantity of the solution deposited.

PRELIMINARY REMARKS

The applicants acknowledge the Examiner's thorough examination of the subject application and request reconsideration and reexamination in light of the preceding amendments and the following remarks.

The Examiner states that should claim 24 be found allowable, claim 25 will be objected to under 37 CRF 1.75 as being a substantial duplicate thereof. The applicants respectfully disagree with the Examiner. The oscillator device recited in claim 25 is configured to output a signal which drives the membrane at a reference resonant frequency: Specifically, claim 25 recites in part: "an oscillator device connected to a first transducer disposed on said membrane, the oscillator device configured to output a signal which drives said membrane at a reference resonant frequency." Claim 24 is silent as to whether the

oscillator device is configured to output a signal and recites only that oscillator device is for driving the membrane at a reference resonant frequency. Therefore, claim 25 is not a substantial duplicate of claim 24.

The Examiner rejects claim 23 under 35 U.S.C. §112, second paragraph as being indefinite. The Examiner states that claim 23 merely recites a desired result without providing any additional structure for obtaining the desired result. In response, as shown above under AMENDMENT B, the applicants have amended claim 23 to now recite that claim 23 now depends from claim 1 and further defines that the mass determining device measures the mass of a substance in the range of about 100 picogram/mm^2 to 100,000 picogram/mm^2." Accordingly, claim 23 is now definite and in accordance with 35 U.S.C. §112, second paragraph and the Examiner's rejection of claim 23 should be withdrawn.

The Examiner rejects claims 1-3, 5, 7-8, 15, 17-18, and 22-23 under 35 U.S.C. §102(b) as being anticipated by White et al. (U.S. Patent No. 5,218,988).

The apparatus for measuring the mass of a substance as claimed by the applicants in claim 1 includes: 1) a sensor having a membrane layer, the membrane for receiving the substance thereon; 2) an oscillator device configured to output a signal which drives said membrane at a reference resonant frequency; 3) a frequency detection device configured to determine a change in the reference resonant frequency caused by the presence of the substance on the membrane; and 4) a mass determining device configured to <u>determine the mass of the substance</u> wherein the amount of change in the reference resonant frequency is indicative of the <u>mass</u> of the substance.

In sharp contrast, White et al. does not teach, suggest, or disclose an apparatus for <u>measuring</u> the mass of a substance. Instead, White et al. teaches an apparatus for detecting

the presence of a substance by using gels and coatings which are exposed to the presence of the substance. Specifically, White et al. teaches and discloses detecting whether a chemical mass is present by measuring the change in frequency: "If, however, the propagation medium of the new sensor of the present invention is coated with a layer of a suitable gel, the gel can screen out massive cells and molecules while detecting smaller molecules." (Col. 7, lines 39-43, emphasis added), and "The gel coating may also be placed over a porous and permeable membrane 22', as shown in Fig. 16. The process of putting the gel on such a membrane could be done with the aid of surface tension . . . Such a process may help to increase chemical selectivity of the sensor in detecting which of certain possible substances were present." (Col. 16, line 67 - Col 17, line 18, emphasis added).

For the reasons set forth above, White et al. does not teach, suggest, or disclose a mass determining device configured to determine the mass of the substance wherein the amount of change in the reference resonant frequency is indicative of the mass of the substance as recited in applicants' claim 1. Instead, White et al. teaches and discloses the use of gels and coatings to detect whether a chemical is present by measuring the change in frequency. Moreover, White et al. actually teaches away from the applicants' claimed invention as recited in applicants' claim 1.

The Examiner alleges White et al. discloses a sensor for measuring the mass of a substance on a membrane by the disclosure at col. 11, lines 61-68 which reads: "[s]ince the Lamb-wave device responds to changes of membrane tension, surface loading, and changes in transducer dimensions, it is suited to a number of mechanical applications. A force applied to the membrane directly or to the substrate, strains the membrane and causes a change in oscillator frequency. Thus, the sensor could be employed as a scale for weighing

very small masses". However, at Col. 12, lines 14-21 White et al. clearly discloses: "Loading one or both sides of the membrane 22 with a fluid can cause large velocity changes and oscillator frequency shifts. Analysis shows that the magnitude of the change depends primarily upon the density of the fluid, the sound velocity in the fluid having a somewhat smaller effect." (Emphasis added). It is impossible to simultaneously measure density and mass with one measurement device. White et al. specifically teaches measuring the magnitude of the change of the frequency to determine the density of the fluid. To determine the mass using the device as disclosed by White et al, the mass would have to be manually calculated by multiplying the measured density by the volume. Therefore, White et al. clearly does not teach, suggest and disclose mass determining device configured to determine the mass of a substance as recited in applicants' claim 1.

Accordingly, for the reasons set forth above, White et al. does not teach, suggest, or disclose an apparatus for measuring the mass of a substance as claimed by the applicants in independent claim 1. Instead, White et al. teaches an apparatus for the detecting the presence of a substance on a coating by the use of gels and coatings which are exposed to the substance. Moreover, the alleged mass sensing device as taught and disclosed by White et al. (e.g., at Col. 11, lines 61-68) is not designed for measuring the mass of substance.

Therefore, White et al. does not teach, suggest, or disclose each and every element of the applicants' claimed invention, namely, a mass determining device configured to determine the mass of the substance wherein the amount of change in the reference resonant frequency is indicative of the mass of the substance as recited in claim 1.

Accordingly, claim 1 is clearly allowable and patentable under 35 U.S.C. §102(b) and the Examiner's rejection of claim 1 should be withdrawn. Because claim 17 is a method of

measuring the mass of a substance for the apparatus recited in claim 1, claim 17 is also allowable and clearly patentable under 35 U.S.C. §102(b). Further, because dependent claims 2, 3, 5, 7-8, 15, 18, 22, and 23 depend from allowable base claims, claims 2, 3, 5, 7-8, 15, 18, 22, and 23 are clearly allowable and patentable under 35 U.S.C. §102(b).

The Examiner rejects claims 4, 6, and 23 under 35 U.S.C. §102(b) as being anticipated by White et al. The Examiner rejects claims 11, 24, and 25 under 35 U.S.C. §103(a) as being unpatentable over White et al. The Examiner rejects claims 8-10, 18, 19, and 22 under 35 U.S.C. §103(a) as being unpatentable over White et al. in view of Bowers. The Examiner also rejects claim 16 under 35 U.S.C. §103(a) as being unpatentable over White et al. in view of Ballato.

As stated above, White et al. does not disclose each and every element of the applicants' invention as recited in independent claims 1 and 17. Because claims 4, 6, 8-10, 11, 16, 18, 19, 22, and 23 depend from an allowable base claim, claims 4, 6, and 23 are allowable and patentable under 35 U.S.C. §102(b) and claims 8-10, 11, 16, 18, 19, 22 and 23 are allowable and patentable under 35 U.S.C. §103(a).

White et al. also does not teach, suggest, or disclose each and every element of the applicants' claimed invention as recited in applicants' independent claims 24 and 25, namely, a mass determining device connected to the frequency detection device for determining the mass of the substance, the amount of change in the reference resonant frequency being indicative of the mass of the substance. Accordingly, claims 24 and 25 are allowable and patentable under 35 U.S.C. §103(a).

To advance prosecution, the applicants have added claims 26-30. The method of measuring the concentration of particles in a solution as claimed by the applicants in claim

26 includes the steps of: 1) depositing a measured quantity of the solution on a sensor having a membrane layer; 2) allowing the solution to evaporate until the particles remain on the membrane layer; 3) driving the membrane layer at a reference resonant frequency; 4) detecting the shift in frequency of the membrane layer due to the mass of the particles; 5) determining the mass of the particles based on the shift in frequency; and 6) based on the measured quantity of the solution and the mass of the particles, automatically calculating the concentration of the particles in the solution.

Clearly, nowhere is the disclosure of White et al. is a teaching, suggestion, or disclosure of depositing a measured quantity of the solution on a sensor having a membrane layer, allowing the solution to evaporate until the particles remain on the membrane layer determining the mass of the particles, and based on the measured quantity of the solution and the mass of the particles, automatically calculating the concentration of the particles in the solution as recited in new claim 26. New claim 27 further refines claim 26 by indicating that the measured quantity of the solution is deposited on a flexural plate wave device.

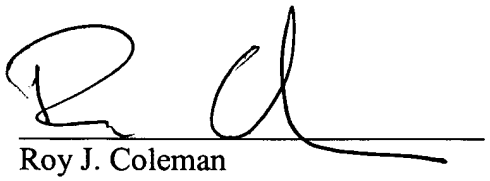
The concentration detection system as now claimed by the applicants in new claim 28 includes: 1) a sensor having a membrane layer, the membrane layer for receiving a substance thereon; 2) an oscillator for driving the membrane layer at a reference resonant frequency; 3) a solution deposition device for delivering a known quantity of a solution containing particles to the membrane layer; 4) a transducer for detecting the change in frequency of the membrane layer due to the particles after the solution evaporates; and 5) a processor configured to automatically determine the mass of the particles based on the change in frequency, and to calculate the concentration of the particles in the solution based on the mass of the particles and the quantity of the solution deposited.

Clearly, nowhere is the disclosure of White et al. is a teaching, suggestion, or disclosure of a solution deposition device for delivering a known quantity of a solution containing particles to the membrane layer, a transducer for detecting the change in frequency of the membrane layer due to the particles after the solution evaporates, and a processor configured to automatically determine the mass of the particles based on the change in frequency, and calculate the concentration of the particles in the solution based on the mass of the particles and the quantity of the solution deposited as recited in added claim 28. New claims 29 and 30 further refine claim 28 by reciting that the sensor is a flexural plate wave device. Accordingly, new claims 26-30 are clearly patentable.

Each of the Examiner's rejections has been addressed or traversed. Accordingly, it is respectfully submitted that the application is in condition for allowance. Early and favorable action is respectfully requested.

If for any reason this Preliminary Amendment is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates, collect in Waltham, Massachusetts, at (781) 890-5678.

Respectfully submitted,



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